

An Empirical Analysis of Bank Capital Adequacy Ratio in Vietnam: A Data Science Approach Using System Generalized Method of Moments

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Abstract

Capital adequacy ratio is an important indicator when evaluating banks' safety and risk management activities. Therefore, commercial banking system is increasingly moving towards international standards is a prerequisite to ensure the reduction of systemic risks in banking. Besides, commercial banks and the financial industry face considerable hurdles in light of the fourth Covid-19 outbreak. Commercial banks continuously put capital adequacy measures in place to fulfill Basel regulations. One of the main ways they do this is by issuing bonds, which boost tier 2 capital sources. This helps mobilize capital and assure capital safety for the market's borrowing requirements in the long run. As a result, considering both external and internal variables, this research seeks to investigate what influences the capital adequacy ratio of Vietnam's joint-stock commercial banks. Between 2011 and 2022, the authors combed through data from 25 different Vietnamese joint-stock commercial banks. The authors employed the system generalized method of moments model and other conventional techniques for panel data analysis. The study's findings had fourteen components affecting the capital adequacy ratio, with a significance of 0.01. Therefore, it is evident that the equity capital of Vietnamese commercial banks has successfully met the required safety standards for assets with credit risk as per legislation. As a result, this assists Vietnamese commercial banks in managing potential losses from credit activities, thus assuring the security of banking operations and protecting depositors. However, the issue suggests policy implications for enhancing Vietnamese commercial banks' future capital adequacy ratio coefficient.

Keywords: Bank, Capital Adequacy Ratio, SGMM, Covid-19, Vietnam

1. Introduction

There have been some encouraging developments in Vietnam's commercial banking sector lately. The good news is that over 25 commercial banks have modified their capitalization favorably, which is an excellent indicator that The State Bank of Vietnam (SBV) requested Basel II in Circular No. 41/2016/TT-NHNN, dated December 30, 2016, issued by the Governor of the SBV, which stipulates capital adequacy criteria for banks and spending some institutions, including International Commercial Joint Stock Bank, Vietnam Maritime Commercial Joint Stock Bank, and Ho Chi Minh City Development Commercial Joint Stock Bank, are planning to finish Basel III, as are international bank branches. Fitch Ratings did point out that, compared to foreign banks, Vietnam's commercial banking sector still lacks capital and that banks' CAR will drop in the next two to three years due to the country's high loan growth rate reduction in the absence of an appropriate plan for the bank's capital increase. Securing the entire system is at risk if bank CARs decline. The opposite is true: higher credit ratings and more market competitiveness will result from an improvement in banks' CAR, particularly the State Bank's policy on priority credit acceptance on a global scale. An economic indicator, CAR, shows how a bank's equity capital compares to its risk-adjusted assets. There are a lot of variables influencing CAR within the framework of global economic integration; some of these elements are under banks' control, while others are beyond them; impacting the recent Covid-19 epidemic is one of the usual issues that has to be noted. Based on the mentioned things, the research's objectives are to explore critical factors affecting the capital adequacy ratio from 25 different Vietnamese joint-stock commercial banks from 2011 to 2022.

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In addition, the Covid-19 epidemic has had a devastating impact on Vietnam since 2020. The social distancing measures to combat the Covid-19 pandemic have impacted the commercial banking industry. An essential component in the growth of every economy, the financial system also serves as its very essence. Banks play a crucial role as financial intermediaries, facilitating the transfer of wealth from the well-off to the poor, thereby increasing the economy's capacity to employ capital efficiently. Since it is an intermediary in the financial-monetary sector, the banking system is always sensitive to risk and impacts every industry, and various hazards, including credit, market, operational, and others, confront financial institutions [1]-[2], [15].

Due to its inherent vulnerability, the banking system, if not adequately overseen, runs the danger of collapsing under the weight of excessive bad debt, liquidity strain, loss, or even insolvency, which in turn might trigger an economical financial catastrophe. The collapse of several commercial banks in industrialized nations in the 1970s started the global financial crisis. In light of this, the Basel Committee on Banking Supervision (BCBS) was formed, and the Basel Accord, which sets rules for banking safety, was published by the Bank for International Settlements (BIS). In order to make sure that commercial banks are secure, BCBS has been around for 30 years and published four accords: Basel I, Basel II, Basel III, and Basel IV. Each agreement includes more vital new rules. Consequently, research into what influences Vietnam's joint stock commercial banks' capital adequacy ratio is essential [1], [11]-[12].

2. Literature Review

2.1. Capital adequacy ratio (CAR)

The capital adequacy ratio (CAR) concerns commercial banks' risk tolerance, reflected in the minimum capital adequacy ratio, calculated by comparing equity capital to adjusted assets. This ratio covers the most fundamental hazards banks encounter when running their operations. The Basel Accord, published by the Banking Supervision Commission, is the basis for determining the minimum capital adequacy ratio following international conventions. This ratio is stage-dependent. Although nations are not legally required to adhere to the treaty's obligations, the majority willingly do so to keep the system secure [2], [7]-[8].

On December 30, 2016, the SBV of Vietnam released Circular 41/2016/TT-NHNN, effective the same day, outlining the capital adequacy ratio requirements for banks and foreign branches. The Vietnamese banking system will be regarded as compliant with Basel II on January 1, 2020. This demonstrates that the Basel II implementation in Vietnam is moving slower than in neighboring nations.

The authors note in their study scope that commercial banks' operations use a capital adequacy ratio measurement of equity divided by total risk-adjusted assets. The ownership-owned monetary worth of a bank is called equity capital or the equity of a commercial bank [3].

This money isn't borrowed but instead retrieved from other economic resources. Banks can utilize this money for business, investments in fixed assets, and medium and long-term loans because it comes from the owner's pocket. Since commercial banks are primarily involved in financial intermediary activities, equity capital typically makes up a small fraction of their capital structure. Nevertheless, this is the foundation upon which risk control rules about commercial banking operations are built [4], [11]-[12].

2.2. Factors affecting capital adequacy ratio (CAR)

Clarifying the variables determining banks' CAR has been the topic of previous studies. Since a commercial bank's total existing assets are directly proportional to the amount of that bank's assets, the size of commercial banks' assets can affect CAR. When a bank's total assets go up or down, they grow or shrink, affecting its ability to raise money and lend out products and causing a change in CAR [5], [11]. Prior research on CAR-influencing variables has shown this impact. According to the findings, because bigger banks tend to retain more hazardous assets, the correlation between banking and CAR is negative.

On the other hand, the authors believe that a larger bank will be more successful based on the study results showing that bank size positively affects CAR now diversifying their asset holdings and generally having more capital on hand, reducing risk relative to smaller banks and resulting in a higher CAR [6], [12]-[13]. Therefore, it has been demonstrated that a bank's size affects CAR, which holds true independent of the research component.

Besides, review prior research focusing on international studies using the theoretical groundwork associated with capital structure. Based on their findings, the authors construct a model that accounts for internal and external macro factors and bank-specific variables that affect the CAR coefficient [7]. Given the lack of studies in Vietnam that incorporate macro elements into model construction to determine the factors impacting CAR, this aligns with the implementation of empirical research in Vietnam.

An analysis of return on assets (ROA): The capital adequacy ratio is influenced by profitability, defined as the ratio of total assets to profit after tax. Banks with higher profitability often have a higher capital-to-asset ratio. For starters, having a lot of retained earnings means the bank has a lot of equity capital, meaning it can borrow money cheaply and select a safer lending option [8], [15]. Thus, the study sample is adversely correlated with profitability and capital adequacy ratio, demonstrating the capacity to create profit to expand equity.

First Hypothesis: A negative relationship exists between the minimum capital adequacy ratio and return on total assets.

The DEP is the deposit ratio variable. The deposit ratio is a metric that tracks the amount of capital a bank can raise by comparing its total assets to the number of deposits it has received. Customers' deposits are often seen as a more cost-effective funding source for banks than loans and other comparable financial products. Banks will be compelled to increase their output lending rates in response to depositors' inability to evaluate their financial health, resulting in higher deposit interest rates. Banks are prompted to create more precarious assets due to this dynamic [9], [17]-[18]. According to the report, capital adequacy and deposit ratios are expected to have a positive connection.

The ratio of deposits to capital adequacy ratios of commercial banks is positively correlated, with Hypothesis 2.

Measured as the ratio of a bank's total assets to its cash and equivalents, the liquidity variable (LIQ) shows how liquid a bank is. A bank's liquidity risk is reduced when the proportion of its invested capital held in cash or cash equivalents rises, and it rises again as the proportion of its invested capital held in cash or equivalents falls [11], [19]. Banking operations are more dangerous when the bank's liquidity risk is lower. Put otherwise, a negative association exists between liquidity and the safety coefficient.

Third Hypothesis: CAR negatively correlates with the ratio indicating liquidity.

Variable loan balance to total assets (LOA): This ratio shows how the bank's assets are structured, with outstanding loans as a percentage of total assets. The loan ratio measures a bank's capacity to use and manage capital, as lending is most banks' primary source of profit. The capital adequacy ratio decreases as the bank's risk level increases with a larger ratio [11]-[12], [22]. Thus, it is anticipated that there would be a negative connection between the capital adequacy ratio and the loan-to-total assets ratio.

H4: The loan-to-assets ratio has a negative impact on CAR.

The variable credit provision ratio (LLR) measures a bank's credit quality and considers the loan amount ratio to the provision for credit risks. A credit institution's provision for credit risks is the money they put aside in case their clients don't repay their loans when they say they would. As a measure of the provision needed to cover projected losses in the portfolio for future loan acquisitions, the provision ratio is calculated as the cost of provision divided by the total outstanding amount of the bank on the balance sheet. The capital loss provision harms banks' finances, which makes it harder for them to raise capital and keep their operations secure [13], [21]. Accordingly, the research found a negative link between capital adequacy and credit risk provision ratios.

The fifth hypothesis states a positive correlation between capital adequacy and credit provision ratios.

Non-performing loan ratio (NPL): A bank's bad debt ratio may be calculated by dividing its total outstanding loans by the number of loans in Groups 3, 4, and 5. These loans have a significant credit risk, reflecting the bank's hazardous asset portfolio. Accounts receivable that are three months or more past due, whether for interest or principle, are considered bad debts. It is common practice to utilize the bad debt ratio as a surrogate for credit risk [14], [22]-[23]; this ratio is derived from the sum of all existing loans divided by the total number of loans in groups 3, 4, and 5. The capital adequacy ratio declines with rising credit risk. Capital adequacy and lousy debt ratios are predicted to have a negative association.

Capital adequacy and nonperforming loan ratios should have a negative connection, according to Hypothesis 6.

The leverage factor variable, also known as the leverage coefficient variable (LEV), represents a bank's capital structure by measuring the ratio of its liabilities to its total capital. The ratio of a bank's total debt to its entire ownership is called leverage. In certain situations, the leverage coefficient is small, while in others, it's significant. Decreases in leverage ratio capital adequacy can occur due to an increase in risk, an increase in debt compared to owners, a rise in the cost of capital, and the possibility of lower returns due to inefficient investments [15], [25]-[26]. Capital adequacy ratio and financial leverage do not correlate positively, as predicted by the authors.

Seventh Hypothesis: A negative correlation exists between financial leverage and the capital adequacy ratio.

The bank size variable (SIZE) represents a bank's total assets size, which is determined as the natural logarithm of the bank's total assets. Most high-asset banks' loans are considered hazardous [17], [26]-[27]. The CAR ratio will also take a hit since the bank's development needs, primarily dependent on mobilized capital, outstrip the growth in equity relative to the size of total assets. Hence, the analysis finds that the predicted CAR coefficient is negatively related to the size of the bank [28].

H8: There is a negative correlation between bank size and CAR.

Board size (BoardS): The number of members on a commercial bank's board of directors indicates board size. According to research, the Board of Directors is crucial in ensuring the bank's steady growth. Meanwhile, the Board of Directors can boost company efficiency by effectively carrying out its oversight job [18], [29]-[30]. Research on the correlation between board size and bank risk has provided empirical evidence. As a result, it is reasonable to assume that the CAR coefficient is positively correlated with the size of the bank's board of directors.

H9: There is a positive correlation between board size and CAR.

The percentage of women serving on the board (FemaleB): The percentage of female members on the bank's board of directors is a measure of the representation of women in that body, and it is calculated by dividing the total number of directors by the number of female BOD members. A diverse Board of Directors, including many women, will improve the bank's efficiency [19], [31]. A higher CAR for commercial banks is predicted by the study as a whole when the proportion of female directors is more significant.

Assumption 10: A positive correlation between the percentage of female BOD members and the CAR.

Board of Directors members' varying degrees of education (EduB): An indicator of the proportion of board members holding a graduate degree at Bank I in year t is the educational level of board members (EduB) variable. The variable is calculated by dividing the total number of board members by the fraction of members with graduate degrees [20], [32]-[33], [42]. The higher the level of credentials the Board of Directors holds, the greater the level of safety the bank provides. Hence, the CAR coefficient is positively connected with the relationship between the qualifications of the Board of Directors.

Proposition 11: There is a significant correlation between the CAR coefficient and the percentage of board members having doctoral degrees.

The Consumer Price Index (CPI) measures a country's inflation rate. Borrowers and consumers alike will feel the effects of a depreciating currency due to inflation, which affects the nominal interest rate and renders debt repayment impossible. Put simply, banks have a higher risk of credit defaults when inflation is substantial [21], [34]-[35]. The capital ratio of banks might be adversely affected by this. Theoretically, the CAR coefficient is negatively impacted by high inflation since it indicates economic instability and poses various hazards to financial activity [36], [37]-[38].

Theory H12: There is a negative correlation between inflation and CAR.

The economic growth rate, often known as GDP, is determined by dividing the difference between two consecutive periods' economic sizes by the preceding periods' economic sizes. Based on the research, no positive correlation was found between GDP and CAR. This makes sense, given that banks tend to engage in various sectors and disciplines while underestimating the risks involved during periods of healthy economic expansion [22], [39]-[40]. Investments

and loans grow riskier when volatility rises, and banks may not have sufficient reserve capital to handle these risks. Consequently, we should anticipate an inverse sign for the link between CAR and economic growth rate.

H13–The Hypothesis: CAR is related to GDP growth in a positive correlation.

Possible Covid-19 pandemic (Dummy: D): The commercial banking industry and Vietnam's socio-economic situation are profoundly affected by the ongoing Covid-19 epidemic. The exact nature and trajectory of these effects are difficult to anticipate. Numerous agreements have been published by the State Bank of Vietnam (SBV), enabling commercial banks to reorganize the payback period, eliminate or lower interest rates, keep the same debt group, and alleviate client loan problems. The Covid-19 pandemic affects Vietnam's CAR index and other commercial banking indicators [41]–[42]. The Covid-19 pandemic has profoundly affected the globe, particularly Vietnam, since the beginning of 2020, causing changes not seen in decades. Stagnation in production and business has a devastating impact on the economy. Declining activity and diminishing cash flow are business issues, particularly in tourism, entertainment, the automotive industry, retail, etc. Hence, a substantial variable is included in the paper. When considering the CAR coefficient, how does the Covid-19 epidemic factor in?

H14: The Covid-19 epidemic impacts the CAR coefficient.

The authors' study constructs a model with variables assessing the influence of factors based on the theoretical background connected to capital structure and a review of existing research, particularly research conducted abroad. Internal and external variables affect the CAR coefficient, bank features, and macro factors [42]. Since no prior research in Vietnam has included macro variables in model construction to identify determinants impacting CAR, this is in line with the results of empirical studies conducted in the country:

$$\begin{aligned} CAR_{it} = & \beta_0 + \beta_1(ROA_{it}) + \beta_2(DEP_{it}) + \beta_3(LIQ_{it}) + \beta_4(LOA_{it}) + \beta_5(LLR_{it}) + \beta_6(NPL_{it}) + \beta_7(LEV_{it}) \\ & + \beta_8(SIZE_{it}) + \beta_9(BOARDS_{it}) + \beta_{10}(Female_{it}) + \beta_{11}(Edu_{it}) + \beta_{12}(CP_{it}) + \beta_{13}(GDP_{it}) \\ & + \beta_{14}(D_{it}) + \varepsilon_{it} \end{aligned}$$

The CAR of bank i in year t is the dependent variable. Independent factors: Factors representing the bank's characteristics and variables connected to macroeconomic circumstances are among the independent variables utilized in the model, illustrating the factors impacting the capital adequacy ratio.

3. Method

3.1. Qualitative research

The essay uses qualitative research methods derived from the established research procedure, such as capital and capital safety, and the elements that influence it are the subjects of the authors' analysis and synthesis. A theoretical foundation for the article's research problem is established by identifying trends and research viewpoints of many authors on the research problem based on each problem [10]. Also, the comparative technique involves comparing, analyzing, and evaluating the system's micro and macro components using tables and graphs created from secondary data. The number of commercial banks that have sufficient capital. With some tweaks and additions, the authors extracted variables impacting the minimum CAR from domestic and international theories and research papers. In order to determine what factors, influence capital sufficiency, the authors reviewed and synthesized materials about capital. Finding research trends and authorial viewpoints on each research problem provides a theoretical foundation for the article's research problem [10]. Furthermore, the comparison approach: The study compares, analyzes, and evaluates the micro and macro elements impacting the coefficient using tables and graphs made from secondary data. The authors derive variables affecting the minimal CAR for commercial banks' capital safety from domestic and international theories and research articles, which they then modify and augment.

3.2. Quantitative research

The authors employ the following estimate methods: System Generalized Method of Moments (SGMM) from 2011 to 2022; the SGMM model applied to examine the variables impacting the CAR of Vietnamese joint stock commercial banks. Concurrently, the authors employed the Wald F-test, Hausman-test, and Breusch pagan-test to determine which model was most suitable for their research. The authors only applied the System Generalized Method of Moments

(SGMM) for the estimation method, which was first proposed and studied [10] and later refined and expanded to address model defects like endogeneity, autocorrelation, and heteroskedasticity.

The minimum CAR of Vietnamese joint stock commercial banks is examined in this article using a model that has been chosen to explore the effects of various factors on this ratio. The authors sourced secondary data on 25 commercial banks in Vietnam from 2011 to 2022. This database provides completely trustworthy banking data [10]. Prior studies in formal quantitative research have utilized panel data analysis methods, such as the SGMM, as their study methodology. In order to assess research hypotheses, this approach utilizes multivariate linear regression analysis and p-value statistics [10]. Hypothesis violations, including multicollinearity and autocorrelation, are then examined in the research. Finally, the SGMM method is commonly used in estimating linear dynamic panel data or panel data that violates the HAC (Heteroskedasticity and AutoCorrelation) property. At that time, the classic linear estimates of panel data models such as (Fixed effects) or RE (Random effects) will no longer produce reliable estimation results and will be ineffective. To solve these cases, the SGMM method was given priority, and in this study, it was applied with quite suitable results for the data set of 25 commercial banks.

4. Result and Discussion

4.1. Assessing the capital adequacy ratio of 25 commercial banks in Vietnam

In order to safeguard the security and well-being of the banking system, the State Bank of Vietnam has implemented laws about the functioning of the banking system, with a particular focus on capital adequacy requirements. Vietnam has implemented a set of legal documents that specifically govern capital safety, following international standards for safety in the banking system. These documents include regulations on charter capital, tier 1 capital adequacy ratio, and rules on capital adequacy ratio. The law on capital adequacy ratio is particularly noteworthy due to its wide-ranging influence and intricate character. Hence, the authors' primary emphasis in the study is examining rules about the CAR.

Moreover, businesses, notably commercial banks, prioritize profit optimization and maintaining the safety of their operations. The commercial banking system is highly influential across all economic activities and is a crucial cog in the national financial wheel because of its unique nature and specialized business sector. Consequently, there is a global trend toward more stringent risk monitoring of financial activity. An essential metric for safe banking operations, the CAR, was created and refined by the Basel Committee on Banking Supervision. Commercial banks can best weather the storms of volatile financial markets by adhering to the standards set out by the Basel Accord.

As per the suggested plan, Vietnamese commercial banks are progressing towards adopting Basel II capital adequacy rules, as outlined in Circular 41/2016/TT-NHNN. The application of CAR computation, as per Circular 41, would be extended throughout the whole system in Vietnam starting from January 1, 2020. As per Circular 41, banks must maintain a minimum CAR of 8%. The calculation of CAR follows the guidelines set by Basel II, which include credit risk, operational risk, and market risk, rather than only focusing on one of these factors. Compute the CAR based on the rules outlined in Circular 36. The New CAR just considers the credit risk. However, Circular 41 regulations only guarantee the fundamental rules of Basel II for CAR. Hence, the application and computation of CAR in Vietnam possess distinct attributes that distinguish them from those in other nations.

With a total system CAR of 11.8% as of the end of February 2019, state-owned commercial banks accounted for 9.42% and joint stock commercial banks for 10.76%, bringing the minimum capital adequacy ratio for the whole banking system down to 12.37%. At the end of February 2019, the CAR for the entire system and two groups of commercial banks was lower than it had been at the end of 2018. Out of the 25 commercial banks whose reports were summarized at the 2021 annual meeting, 20 have disclosed their CAR coefficients, with some even saying that their 2018 CAR coefficients were better than 2017's. Following State Bank requirements, the other four banks - Vietinbank, OCB, VietA Bank, and LienVietPost Bank - either do not provide particular CAR coefficients or give a broad overview of the Bank's CAR ratios. In 2018, OCB was among the first three banks acknowledged by the State Bank for having completed the worldwide Basel II requirements. Among the 25 financial institutions that disclosed their CAR ratios in 2018, Kienlong Bank stood out with a minimum level of 16.62%. With a charter capital of 3,237 billion VND and total assets of 42,310 billion VND, Kienlong Bank is a small-scale bank. After that comes Techcombank, whose capital adequacy ratio hit 14.3% at the end of 2018.

Descriptive statistics, which offer brief overviews of the data sample and parameters, such as standard deviation and mean from 2011 to 2022, help describe and understand the characteristics of a specific dataset of 25 commercial banks. The following are the outcomes of applying these settings in Stata 13.0 for data analysis and statistical levels:

Table 1. Descriptive statistical results of variables based on 25 commercial banks from 2011 to 2022

Variable	Obs	Mean	Std. Dev.	Min	Max
CAR	300	0.136027	0.01576	0.093	0.178
ROA	300	0.01091	0.00997	0.001	0.077
DEP	300	0.63064	0.126435	0.123	0.894
LIQ	300	0.181727	0.091984	0.045	0.61
LOA	300	0.5456	0.129027	0.145	0.808
LLR	300	0.010953	0.00846	0.001	0.054
NPL	300	0.02276	0.015859	0.002	0.126
LEV	300	11.6913	4.944725	2.916	33.113
SIZE	300	7.997877	0.522338	6.862	9.173
BoardS	300	8.366667	2.154304	4	15
FemaleB	300	0.324717	0.169198	0.071	0.857
EduB	300	0.32404	0.169082	0.067	0.833
CPI	300	5.910833	4.604288	0.63	18.58
GDP	300	5.9275	1.1279	2.91	7.08
D	300	0.083333	0.276847	0	1

Source: Data by processing Stata 13.0; Significant at 1 percent level.

From 2011 to 2022, a grand total of 300 variables were recorded from 25 different commercial banks (Table 2). Since the standard deviation is relatively constant yearly, the outcome mentioned above is first-rate.

Table 2. Analysis of statistical results based on the SGMM model

Code	Coef.	Std. Err.	z	P value	VIF	[95% Conf.	Interval]
ROA	-0.3979	0.0084	-47.4400	0.0000	1.090	-0.4144	-0.3815
DEP	0.0087	0.0014	6.3600	0.0000	2.410	0.0060	0.0114
LIQ	-0.0422	0.0016	-26.9600	0.0000	2.020	-0.0453	-0.0391
LOA	-0.0165	0.0014	-11.4900	0.0000	2.310	-0.0193	-0.0137
LLR	0.3405	0.0136	25.0800	0.0000	1.440	0.3138	0.3671
NPL	-0.0628	0.0059	-10.6500	0.0000	1.090	-0.0744	-0.0512
LEV	-0.0007	0.0000	-20.4700	0.0000	2.110	-0.0008	-0.0007
SIZE	-0.0235	0.0004	-59.7200	0.0000	2.860	-0.0243	-0.0227
BoardS	0.0016	0.0001	17.8100	0.0000	2.190	0.0014	0.0018
FemaleB	0.0145	0.0008	17.4400	0.0000	1.610	0.0129	0.0161
EduB	0.0340	0.0008	42.9000	0.0000	1.860	0.0324	0.0355
CPI	-0.0004	0.0000	-14.2800	0.0000	2.120	-0.0004	-0.0003
GDP	0.0035	0.0002	22.5500	0.0000	4.260	0.0032	0.0038
D	0.0115	0.0007	16.8900	0.0000	4.540	0.0102	0.0129

The mean VIF is $2.28 < 3.0$

Note: CAR is the dependent variable

Source: Data by processing Stata 13.0; Significant at 1 percent level.

Results showed that fourteen variables are shown to be statistically significant (Table 2) at a significance of 0.01; reasonableness dictates that a statistical indicator confirming that evaluating the rise of internal and external elements yields results with "P" values less than 0.01, all of which are statistically significant, banks are more likely to have more money on hand in order to mitigate risks, whereas non-banks are more vulnerable to losses caused by potential economic downturns. The possibility of financial setbacks in times of economic uncertainty. The study article explicitly

mentions a new variable called Covid-19. According to the study's findings, there are statistically significant variations in how banks conduct business during the Covid-19 pandemic.

4.2. Testing factors affecting capital adequacy ratio of commercial banks

Table 3. Testing SGMM model for factors affecting capital adequacy ratio of commercial banks

	Relationships		Standardized estimate	S.E	C.R	P	Results
CAR	<---	ROA	-0.266	0.0084	-47.440	0.0000	H1 has been accepted
CAR	<---	DEP	0.085	0.0014	6.360	0.0000	H2 has been accepted
CAR	<---	LIQ	-0.308	0.0016	-26.960	0.0000	H3 has been accepted
CAR	<---	LOA	-0.205	0.0014	-11.490	0.0000	H4 has been accepted
CAR	<---	LLR	0.137	0.0136	25.080	0.0000	H5 has been accepted
CAR	<---	NPL	-0.044	0.0059	-10.650	0.0000	H6 has been accepted
CAR	<---	LEV	-0.243	0.0000	-20.470	0.0000	H7 has been accepted
CAR	<---	SIZE	-0.779	0.0004	-59.720	0.0000	H8 has been accepted
CAR	<---	BOARDS	0.257	0.0001	17.810	0.0000	H9 has been accepted
CAR	<---	FemaleB	0.116	0.0008	17.440	0.0000	H10 has been accepted
CAR	<---	EduB	0.359	0.0008	42.900	0.0000	H11 has been accepted
CAR	<---	CPI	-0.119	0.0000	-14.280	0.0000	H12 has been accepted
CAR	<---	GDP	0.248	0.0002	22.550	0.0000	H13 has been accepted
CAR	<---	D	0.161	0.0007	16.890	0.0000	H14 has been accepted

Significant at 1 percent level; Source: Data by processing Stata 13.0

Table 3 shows that the above variables impacting banks' capital adequacy ratio are predominantly carried out in nations other than Vietnam. Few domestic studies have addressed this issue, and the data that does exist has certain limitations, such as not being collected over a long enough period, not sampling a large enough number of banks to represent the entire industry, and not taking into account all of the internal and external factors that affect the capital adequacy ratio of the banks. The author examined 25 commercial banks in Vietnam from 2011 to 2022 from the perspective of the banks' internal workings and macroeconomic variables, building on the shortcomings of earlier studies. Furthermore, the authors suggested addressing the defects of panel data regression by utilizing the SGMM approach, R-squared = 0.9152 and Adj R-squared = 0.9110.

Besides, the authors draw management conclusions for bank administrators based on the study's findings, including the need to comply with rules, keep depositors' money secure, and safeguard shareholder gains without sacrificing safety. First, keeping the bank's scale reasonable; expanding the scale by boosting credit operations requires oversight. As a second point, strike a balance between debt and equity by using the financial leverage ratio and other sources of capital to meet credit expansion. Thirdly, regardless of whether earnings are going up or down, banks should consider keeping their capital adequacy ratio reasonable. Bank managers shouldn't give much thought to a strategy that would lower the bank's safety level in pursuit of higher profits via investing in a portfolio of riskier assets. However, the actual state of the market will determine how the management mentioned above principles are put into play. Banks can decrease their capital adequacy requirements and increase their risk appetite during boom cycles in the market.

4.3. Research discussion

Since the Covid-19 pandemic had a significant impact on economic activity in Vietnam from late 2019 into early 2020, and since joint-stock commercial banks saw the destruction the pandemic wreaked on countries like China, the US, the UK, etc., and anticipated potential losses, they increased their risk prevention measures, the study's findings are entirely in line with reality, via fortifying the risk management buffer through raising the risk reserve ratio. As if the Covid-19 pandemic's adverse effects weren't harmful enough, banks have also sent good signals, such as rising income from online banking and electronic payments, which increases the quantity of currency in circulation mostly moved from one bank account to another, assisting financial institutions with attracting more low-interest demand deposits. That opens the door for financial institutions to potentially lower the cost of raising input capital. Also, many banks will avoid dividend payments in 2020 and 2021 to set up capital for future use when CAR is implemented per Circular No. 41/2016/TT-NHNN.

A negative correlation exists between CAR and return on total assets, bad debt ratio, and economic growth. To ensure the safety of their CAR, banks must achieve and sustain a satisfactory level of profitability. The commercial banking sector in Vietnam still has a large amount of genuine bad debt, notwithstanding some promising developments. In addition to handling collateral, reducing customer interest, selling debt to VAMC, suing, using risk provisions, etc., commercial banks must simultaneously implement debt collection strategies for each debt group; the findings are consistent with those of other research written by the same authors [21]-[22], [23]. Simultaneously, the bank's risk management has to be beefed up, loan assessment needs to be better, a customer credit rating system needs to be built, and consumers showing symptoms of lousy debt need to be detected quickly. Improving the precision of client credit risk assessments allows for proactively establishing risk provisions in the event of bad debts. Also, instead of emphasizing high-risk assets like real estate loans and securities investment loans, commercial banks should do more to diversify their portfolios into low-risk ones.

Analyze the consequences of the Covid-19 outbreak. It had many unintended consequences, but one vivacious is that it has accelerated the rate customers use online banking services, leading to decreased fixed expenses that banks incur. The banks have actively advocated using technology and data analysis throughout the Covid-19 outbreak. Additionally, implementing technology will increase the financial system's stability and the banks' resilience during times of crisis. Commercial banks should invest heavily in artificial intelligence, financial technology, blockchain, etc., to speed up digitalizing transactions and business processing activities; the findings are consistent with those of other research written by the same authors [24]-[25], [41]-[42]. They should also devise a strategy to shift their operations from spending money on staff, physical space, and infrastructure by increasing the number of transaction offices, employees per office, and online transactions and digital banking options available to their customers.

5. Conclusion

5.1. Conclusion

This study aims to analyze the factors that impact the CAR of commercial banks in Vietnam from 2011 to 2022. Throughout the research period, 25 commercial banks in Vietnam provided their independently audited financial statements, which the study uses as secondary data to create a comprehensive panel data set. The research used descriptive statistics and the SGMM approach to address any shortcomings. At the 1% significance level, the study indicates that the fourteen criteria listed above are noteworthy. This finding provides a solid foundation for future management recommendations about the CAR of Vietnamese commercial banks. Finally, capital is crucial for surviving economic shocks and failure risks, yet Vietnamese banks still have a shallow level of capital compared to their international counterparts in Asia and the rest of the globe.

Consequently, financial institutions should devise a plan to raise money and make good use of that cash, diversify their channels, solicit more investments, and encourage participation from strategic shareholders. Investment collaboration to boost CAR, free from raising funds from outside sources to keep or expand CAR as intended. Simultaneously, in the era following the Covid-19 epidemic, when inflation rates are expected to rise, banks must enhance their risk management strategies and exercise caution when expanding their loan lines to preserve CAR.

5.2. Recommendations

From research results and general trends, to increase capital for banks and ensure business efficiency in operations, encourage commercial banks to develop stably, and provide system safety, the authors propose some recommendations:

(1) Improving return on total assets (ROA): Increasing charter capital through issuing shares to international and financial investors, among other measures, should be commercial banks' primary objective as they strengthen their financial capability. Vietnamese joint stock commercial banks also have other options for raising funds, such as issuing level 2 bonds, tapping into surpluses, issuing more shares, or tapping into internal resources. Also, commercial banks must deal with bad debts proactively, limiting losses as much as possible, to keep banking operations safe and healthy. Selling bad debt to VAMC is one-way Vietnamese commercial banks focus on tackling bad debt. Commercial banks will be able to lower their risk levels because of it. As a last point, earnings made by joint stock commercial banks are either retained or distributed to current owners in the form of shares. Given that most big commercial banks already have a position and growth opportunities, it is more practical to raise funds from current shareholders rather than find

new banks to maintain their current stock ownership ratio or avoid diluting their stock ownership while still implementing plans for long-term investments. Consequently, shareholders will gladly welcome efforts to solicit funds from existing stockholders.

(2) Improving deposit ratio (DEP): Commercial banks should prioritize depending on the bank's profit level; the earnings retained to raise equity capital could not fulfill the bank's need. The following are some ways that banks can raise more money: Issuing new common stocks, converting bonds into common stocks, and soliciting investment from both local and international investors. A rise in the stock price of the commercial bank throughout the issue term, good financial health, and excellent business outcomes are necessary for this kind of capital raising to be considered successful.

(3) Improving liquidity ratio (LIQ): Commercial banks should prioritize increasing the size of their assets in line with the growth of their capital. Paying close attention to the quality of the enlarged assets is crucial for controlling risks and guaranteeing the safety ratio, which is necessary to meet rules for the capital adequacy ratio to complete capital as per rules. The problem of investment in the activities of commercial banks in Vietnam requires fixing. The regulatory environment permits commercial banks to pool their resources to acquire equity in other financial organizations. The CAR calculation does not consider this equity source for capital contribution, though. Consequently, the CAR coefficient will be negatively affected if one bank has many shares in another commercial bank.

(4) Improving loan ratio (LOA): No matter how much or how little money a bank makes, it has to keep its capital adequacy ratio reasonable. Bank managers shouldn't give much thought to a strategy that would lower the bank's safety level in pursuit of higher profits via investing in a portfolio of riskier assets. However, the actual state of the market will determine how the management mentioned above principles are put into play. Banks can decrease their capital adequacy requirements and increase their risk appetite during boom cycles in the market.

(5) Improving loan-loss reserve (LLR): The problem of cross-ownership in the banking sector is also taken seriously by state banks; as a result, banks should have suitable regulations for the capital that is invested in stocks, whether through purchases of shares or donations to capital. Although there is always the chance of loss associated with credit activities, they generate a disproportionate share of revenues for commercial banks in Vietnam. So, for commercial banks to increase their lending operations in line with development-oriented policies, they want tools to evaluate their assets with risk adjustments to determine how much equity capital they need. Because of this, commercial banks can handle their assets more aggressively concerning the amount of capital they possess.

(6) Controlling non-performing loan ratio (NPL): Commercial banks must prioritize regulatory liquidity requirements while proactively enhancing capital through efficient asset exploitation and operational safety. Rather than hoarding cash, commercial banks should be adaptable in their use of capital by investing in quality papers, which will guarantee profitability and liquidity and ultimately lead to increased profitability. Commercial banks in Vietnam have a high CAR coefficient. Financial institutions dealing with businesses with low operational efficiency or those growing their networks should prioritize increasing earnings by decreasing fixed operating expenses. We need to modernize our processes to increase our capacity for cost control. When that happens, the bank will save money on workers by reducing the number of transaction staff. Meanwhile, technology will increase the pace of transactions, which means operational intensity will rise, productivity will improve, and business operations will be more effective.

(7) Improving leverage ratio (LEV): In order to guarantee adequate capital ratios, banks must evaluate the degree of risk to ascertain the suitable equity capital. Commercial banks should prioritize maintaining high-quality assets and implementing sufficient risk controls while they work to increase their equity capital. For commercial banks to make informed decisions about whether or not to raise equity capital, they must first determine their "risk appetite" and then proactively determine how much capital they will need to expand. Compliance with laws and regulations, such as maintaining the bank's profitability throughout its operations and development, requires administrators to constantly balance risk, ensure safety, and make fair judgments.

(8) Improving bank size (SIZE): Financial institutions should step up their efforts to promote the opening of individual bank accounts and use Joint Stock Commercial Banks as a means of payment. Due to the cheap cost of this deposit type, joint stock commercial banks would do well to pay attention to it. With an increase in these deposits, the bank

can reduce output interest rates, encouraging lending. In order to meet their customers' deposit demands to the fullest extent possible, Joint Stock Commercial Banks should aggressively diversify their capital mobilization forms while also maintaining and improving established methods. There are many options for depositing and paying for savings accounts, each with its conditions and interest rates. Banks should enhance and broaden their banking services to help diversify customers' payment deposit options. Enhance the quality of services provided to attract more money to the interbank market and raise the share of deposit capital held by economic entities. Capital mobilization in foreign currency should be expanded and diversified. Furthermore, joint stock commercial banks must increase their liquidity and profitability. Commercial banks also have a responsibility to their clients to offer cutting-edge banking services, including expanding their product lines and services and constantly enhancing their items. Customers' demands are becoming more varied, and convenient goods cater to that. It is imperative that commercial banks in Vietnam work toward the goal of becoming digital banks that facilitate financial transactions via the use of smart devices.

(9) Improving Board of Directors (BoardS): A bank's Board of Directors is essential for some reasons, including keeping an eye on the executive board's actions and guiding the bank's growth. Consequently, in principle, the CAR coefficient is influenced by the board of directors. According to an empirical study, the CAR coefficient positively correlates with board size. This demonstrates how larger boards might help Vietnamese commercial banks improve their capital adequacy ratio. Commercial banks must assess the size of their operations to decide the number of board members suitable for increasing the ability to oversee, inspect, and direct banking activities; this is because a giant board results in a higher capital adequacy ratio. In light of this, the CAR coefficient should be raised following best practices worldwide. Another crucial component in ensuring safe, healthy, and successful bank operations and increasing profitability is banks' ability to develop the managerial capability of commercial banks. Commercial banks may increase their management capacity, decrease operational expenses, and maximize resource use efficiency with the proper management equipment. Commercial banks in Vietnam will soon be obligated to construct suitable governance structures following Basel II as the regulation is implemented system-wide in the banking sector. Creating a model for risk management.

(10) Improving the Board of Female (FemaleB): The system as a whole is affected by the governance at Vietnamese commercial banks and the structure of the Board of Directors, which affects the Board of Directors' motivation and ability to oversee and advise management levels. The number for capital protection. Because commercial banks in Vietnam are undergoing a broad reorganization plan, it is clear that a good corporate governance system is a crucial component of this state industry to evolve into contemporary, market-based financial institutions and function as a catalyst for economic expansion. Furthermore, this study's findings add to the knowledge that Vietnamese commercial banks may use to guide and plan their future changes. The success of commercial banks is strongly related to the number of women on their boards of directors and the quality of their employees' training and development opportunities. More and more, banking operations are utilizing cutting-edge technology, which in turn necessitates a more competent banking workforce to comply with ever-tightening regulations and global standards at a high level. As a result, commercial banks, particularly those with a majority of female officers, need a strategy to cultivate and advance their people resources in line with the innovative needs of the bank.

(11) Improving Board of Education (EduB): Commercial banks should prioritize candidates with strong academic credentials and relevant work experience when choosing new board members. Further, board members should be well-informed about their responsibilities in banking operations and strive to improve themselves regularly, particularly in the areas of education and awareness directly tied to banking. Besides, financial institutions are always at the forefront of directing and organizing training and knowledge-fostering initiatives, particularly those about managerial abilities, operational proficiency, and leadership development at all system levels. The goal of the banking system is to satisfy the demands of providing top-notch products and services to clients by progressively improving the quality of human resources following worldwide standards. Reviewing the spending structure, cutting unfeasible investments, reducing welfare expenditures that exceed the economy's capacity, and reforming the state management apparatus that is cumbersome and ineffective are all necessary steps for the government to take to control state budget spending, from the federal to the local levels. Equitizing state-owned firms, reducing expenditures by maximizing income streams (particularly tax collection), etc. Lastly, reducing the amount of money that may be printed to cover budget deficits.

Furthermore, the government's monetary policy remains restrictive since a rise in the money supply is the primary driver of demand-pull inflation. Reducing the money supply will immediately lower the demand for liquidity in society.

(12) Controlling consumer price index (CPI): Economic growth, stability, safety, and health must be prioritized by the government in order to foster the expansion of commercial banks and other financial institutions. Businesses can run more efficiently and reduce bad debts when the economy is stable and developing. The State Bank's aggressive and flexible monetary policy management has helped bring inflation under control, stabilize the economy, and spur growth. Instruct financial institutions to conduct effective credit growth strategies, including credit quality control, and encourage reorganization of financial institutions related to bad debt management.

(13) Improving gross domestic product (GDP): Sustainable economic development is necessary for the government. Issues of sustainable development and shared wealth, in addition to growth content and programming about air pollution, transportation infrastructure restrictions, urbanization, gender equality, and ethnic minorities, should be considered carefully. Boosted growth and revenue can be achieved by addressing these issues. Vietnam must prioritize sustainable development and equitable growth to escape the middle-income trap and become a modern, advanced economy. Lastly, a well-developed and uniform legal corridor should connect all relevant government papers. The policies of the state must be consistent. Specifically, ensuring the economy is stable at the macro level, prioritizing efficient and sustainable development, and providing open and honest competition are essential. Enterprises' yearly financial performance and production and commercial operations should be publicly disclosed for the government to enforce punishments. Strengthen bank management's ability, establish defined roles and duties for bank executives, and crack down on reporting and financial information infractions.

(14) Controlling the Covid-19 pandemic (D): The efficacy of current risk management practices, including operational risks caused by epidemics and natural catastrophes, should be reevaluated by commercial banks. Commercial banks should take this time to assess the efficacy of their present human resource systems and operational procedures and identify any areas needing improvement. Commercial banks also optimize operational expenses by identifying good workers and reducing personnel that aren't required. Moreover, the outbreak presents a chance for commercial bank executives to reevaluate their policies in light of new dangers, make preemptive adjustments or reconstruct potential situations, and ultimately develop unique solutions and improved strategies for responding to the Covid-19 pandemic.

Disadvantages and recommendations for more investigation: In order to accomplish the study goals and provide answers to the research questions, the authors have used a mix of qualitative and quantitative research methodologies to describe, show, and evaluate the research concerns. Nevertheless, the findings and limitations of each study publication must be considered. The study does have several limitations, which are commensurate with the breadth and duration of the research: (i) all 25 domestic commercial banks were considered in the study. These banks included publicly traded and privately held institutions, those with no joint ventures, and those with 100% foreign ownership. This makes it challenging to evaluate variables that affect the CAR coefficient. Hence, it is necessary to include international and state banks in future research. (ii) over the study period, there were changes to the legislative aspects of managing CAR coefficients. Consequently, in order to make suggestions about closer management methods, the study has not examined the effects of this legislative change on the CAR coefficient. In order to better understand what variables influence the CAR coefficient of commercial banks in Vietnam, this is also a new avenue for study to explore in the future.

6. Declarations

6.1. Author Contributions

Conceptualization: N.Q.H., L.P.N., and P.T.T.; Methodology: P.T.T.; Software: N.Q.H.; Validation: N.Q.H., L.P.N., and P.T.T.; Formal Analysis: N.Q.H., L.P.N., and P.T.T.; Investigation: N.Q.H.; Resources: L.P.N.; Data Curation: L.P.N.; Writing Original Draft Preparation: N.Q.H., N.Q.H., and P.T.T.; Writing Review and Editing: L.P.N., P.T.T., and N.Q.H.; Visualization: P.T.T.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

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6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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